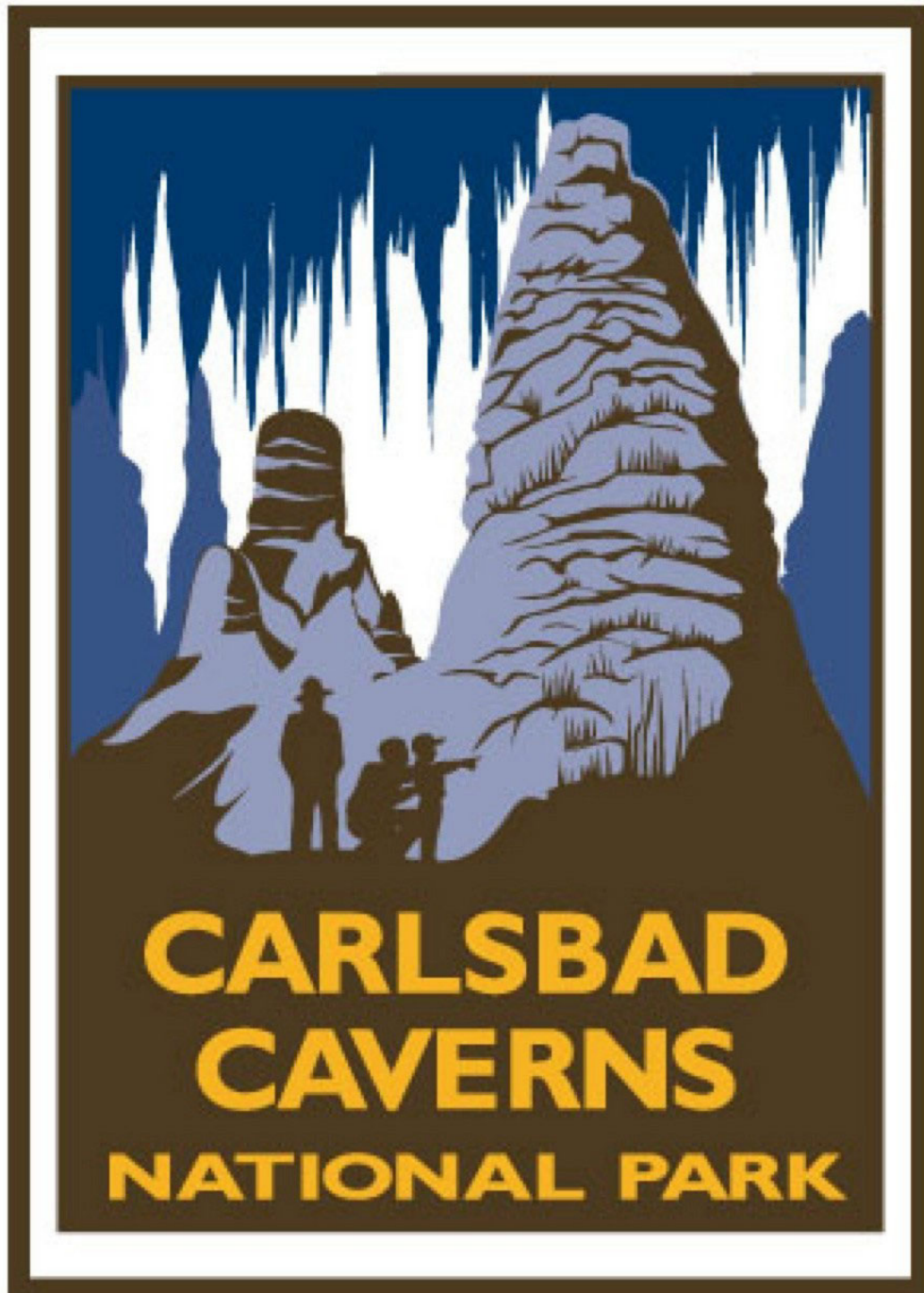


Life Science

A curriculum and activity guide for Carlsbad Caverns National Park



Middle School Biology



Life Science

Biology Curriculum

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CONTENT STANDARDS WITH BENCHMARKS

Science

Unifying Concepts and Processes

CONTENT STANDARD 1

Students will understand science concepts of order and organization.

SC1-E1

Students will apply information about the predictability and organization of the universe and its subsystems.

SC1-E2

Students will apply prediction to scientific problems and events.

CONTENT STANDARD 2

Students will use evidence, models, and explanations to explore the physical world.

SC2-E1

Students will identify and organize evidence needed to predict changes in natural and artificial systems.

SC2-E2

Students will organize phenomena into hypotheses, models, laws, theories, principles, and paradigms.

SC2-E3

Students will design and develop models.

CONTENT STANDARD 3

Students will use form and function to organize and understand the physical world.

SC3-E1

Students will explain function by referring to form and explain form by referring to function.

CONTENT STANDARD 4

Students will understand the physical world through the concepts of change, equilibrium, and measurement.

SC4-E1

Students will illustrate that constancy and change are properties of objects and processes.

SC4-E2

Students will illustrate that energy and matter can be transformed and changed but the sum remains the same.

SC4-E3

Students will use elementary scientific devices to measure objects and simple phenomena.

SC4-E4

Students will employ mathematics to quantify properties of objects and phenomena.

SC4-E5

Students will relate the contributions of external and internal forces to change in the form and function of objects, organisms, and natural systems.

Science as Inquiry**CONTENT STANDARD 5**

Students will acquire the abilities to do scientific inquiry.

SC5-E1

Students will use the scientific method within the classroom and school environment.

SC5-E2

Students will employ equipment, tools, a variety of techniques, and information sources to gather, analyze, and interpret data.

SC5-E3

Students will explain that scientific theories emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories. Well-accepted scientific theories are formulations of apparent relationships or underlying principles of certain observed phenomena that have been verified to a very high degree.

CONTENT STANDARD 6

Students will understand the process of scientific inquiry.

SC6-E1

Students will use different kinds of methods, including observation, experiments, and theoretical and mathematical models to answer a variety of scientific questions.

SC6-E2

Students will use their own understanding of science to guide their scientific investigations.

SC6-E3

Students will use criteria for sound scientific investigations to verify the truth of the results of their own and others' investigations.

SC6-E4

Students will choose appropriate methods and analytic techniques for specific science problems and investigations.

SC6-E5

Students will use technology and scientific methods to gather evidence to enhance the accuracy of their findings.

SC6-E6

Students will describe the results of investigations with teachers, peers, parents, and others.

SC6-E7

Students will explain that scientific investigations can result in new ideas, objects, methods, techniques, and procedures for investigation.

SC6-E8

Students will explain that in areas where there is not a great deal of experimental or observational evidence, it is typical for scientists to differ with one another about the theory, hypothesis, or evidence being investigated.

Physical Science**CONTENT STANDARD 7**

Students will know and understand the properties of matter.

SC7-E1

Students will identify the characteristic properties of elements and compounds such as density, boiling point, and solubility.

SC7-E2

Students will explain that the characteristic properties of an element or compound are independent of the amount (size) of the sample.

SC7-E3

Students will discriminate between elements based on the characteristic ways in which they react with other elements to form compounds that are different substances with unique characteristic properties.

CONTENT STANDARD 8

Students will know and understand the properties of fields, forces, and motion.

SC8-E1

Students will explain that when an object is not being subjected to a force, the object will continue to move at a constant speed and in a straight line.

SC8-E2

Students will describe quantitatively how an object's position, speed, and direction explain motion.

SC8-E3

Students will compare and contrast gravity to other forces in the world and universe.

CONTENT STANDARD 9

Students will know and understand the concepts of energy and the transformation of energy.

SC9-E1

Students will apply knowledge about energy and energy transformation to science problems.

SC9-E2

Students will explain how chemical reactions can take place in time periods ranging from less than a second to millions of years.

SC9-E3

Students will explain how chemical reactions involve concentration, pressure, temperature, and catalysts.

Life Science**CONTENT STANDARD 10**

Students will know and understand the characteristics that are the basis for classifying organisms.

SC10-E1

Students will use information about living things including:

- The roles of structure and function as complementary in the organization of living systems.
- Cells as the fundamental unit of life.
- The functions of cells which sustain life.
- Cell division.
- The use of nutrients by cells.
- The role of heredity and environment in the characteristics of individual organisms.
- That small genetic differences between offspring and parents may accumulate in succeeding generations and may or may not be advantageous for the species.
- Disease as a breakdown in the structures or function of an organism.

SC10-E2

Students will categorize organisms according to reproductive and other characteristics.

CONTENT STANDARD 11

Students will know and understand the synergy among organisms and the environments of organisms.

SC11-E1

Students will distinguish among organisms based on the way an organism regulates its internal environment in relation to changes in its external environment.

SC11-E2

Students will describe how organisms obtain and use resources, grow, reproduce, and maintain a stable internal environment while living in a constantly changing external environment.

SC11-E3

Students will predict behavior in relation to changes in an organism's internal and external environments.

SC11-E4

Students will use knowledge of population characteristics to distinguish specific populations.

SC11-E5

Students will categorize organisms based on the function they serve within their ecosystem.

SC11-E6

Students will examine the impact humans have had on other species and natural systems over time.

SC11-E7

Students will illustrate the impact that overpopulation might have on various regions of the world.

SC11-E8

Students will analyze consumption of nonrenewable resources based on population factors (birth rate, death rate, and density).

SC11-E9

Students will illustrate the role of personal control of basic needs on health outcomes.

SC11-E10

Students will model responsible health behaviors for peers and others.

SC11-E11

Students will demonstrate the impact of nutrition and exercise on personal health.

Earth and Space Science**CONTENT STANDARD 12**

Students will know and understand properties of earth science.

SC12-E1

Students will explain how Earth's materials can be transformed from one state to another.

SC12-E2

Students will experiment with the uses of Earth's materials as resources.

SC12-E3

Students will model natural processes that shape the Earth's surface.

SC12-E4

Students will observe, measure, and record weather changes that occur daily.

SC12-E5

Students will explain how fossils are formed and how fossils provide evidence of the complexity and diversity of life over time.

SC12-E6

Students will use a rectilinear coordinate system such as latitude and longitude to locate points on the surface of Earth.

SC12-E7

Students will describe the interaction between the Earth's lithosphere, hydrosphere, atmosphere, and biosphere.

CONTENT STANDARD 13

Students will know and understand basic concepts of cosmology.

SC13-E1

Students will model the predictable patterns of the sun and planets in the solar system.

SC13-E2

Students will describe the elements of the universe including stars, galaxies, dust clouds, and nebulae.

SC13-E3

Students will explain various scientific theories for the origin of the universe.

SC13-E4

Students will explain how instruments and vehicles are used for space exploration work.

Technology and the History of Science**CONTENT STANDARD 14**

Students will know and understand the differences between the interactions of science and technology.

SC14-E1

Students will design and conduct experiments that distinguish between natural and artificial objects and materials.

SC14-E2

Students will demonstrate trade-offs in safety, cost, efficiency, and appearance related to technological solutions provided through science.

SC14-E3

Students will compare and contrast a variety of scientific and technological solutions to problems.

SC14-E4

Students will examine the role of technology, particularly computers and other electronic advances, in the advancement of science.

CONTENT STANDARD 15

Students will know and understand the impact between science and technology in society.

SC15-E1

Students will illustrate the impact that work settings have on scientific investigations.

SC15-E2

Students will demonstrate how the direction for scientific investigations is related to social issues and challenges.

SC15-E3

Students will explain how the benefits of science and technology are enjoyed by some groups and not by other groups.

SC15-E4

Students will compare and contrast the science contributions of people with diverse interests, talents, qualities, and motivations from a variety of social and ethnic backgrounds.

SC15-E5

Students will predict new areas of scientific inquiry based on previous research.

SC15-E6

Students will analyze the impact of culture, gender, and other factors on an individual's choice of science as a career.

SC15-E7

Students will differentiate between ethical and unethical scientific practices and research.

Science in Personal, Social and Environmental Perspectives**CONTENT STANDARD 16**

Students will know and understand the relationship between natural hazards and environmental risks for organisms.

SC16-E1

Students will analyze environmental risks for personal and social costs.

SC16-E2

Students will determine options for reducing and eliminating environmental risks and for coping with natural catastrophic events.

SC16-E3

Students will predict the human and financial costs of slow natural events such as drought and rapid natural events such as earthquakes.

SC16-E4

Students will develop models for prevention of substance abuse including tobacco, alcohol, and other drugs, and to reduce the associated environmental risks.

Biology Glossary

A

Adaptations a behavior, physical feature, or other characteristic that helps an animal survive and make the most of its habitat; the way any living thing is fitted to the life it leads.

Alternation of generations life cycle in which haploid and diploid generations alternate with each other. The haploid-diploid life cycle is the most complex life cycle and thus has lots of variations. It is also the most common life cycle among plants since all land plants are haploid-diploid.

Animalia one of the 5 major kingdoms. Contains all animals.

Anther the tip of a flower's stamen; contains the pollen.

Axil the angle between the upper side of the stem and the leaf or petiole.

Axillary bud a bud that develops in the axil.

B

Bacteria a unicellular microorganism associated with processes of putrefaction, fermentation, and causes diseases in plants and animals.

Biothems cave bacteria.

Byproduct something produced in the making of something else; a side effect.

C

Camouflage a means of concealment or a disguise that creates the effect of being part of the natural surroundings.

Carnivora typically flesh-eating animals.

Carpel (pistil) is the structure in a flower that consists of the stigma, a style, and an ovule-containing ovary; the

ovule becomes the seed and the ovary becomes the fruit.

Cave a hollow or natural passage under or into the Earth with an opening to the surface.

Cell is a structural and functional unit of an organism; the small structure capable of performing all the functions necessary for life.

Cell membrane a thin layer of protein and fat that surrounds the cell, but is inside the cell wall, and is semi permeable.

Cell organelles small, often membranous, structure in the cytoplasm, having a specific structure and function.

Cell wall a thick, rigid membrane that surrounds a plant cell; gives a plant most of its support and structure.

Centrosome a small body located near the nucleus—it has a dense center and radiating tubules. The centrosome is where microtubules are made.

Charles Darwin wrote *The Origin of Species*, animals evolved through evolution.

Chemolithotrophs specialized prokaryotes that are able to oxidize inorganic chemicals as their sole source of energy and reducing power.

Chlorophyll green plant pigment that absorbs the sunlight needed for photosynthesis.

Chloroplasts elongated or disc-shaped organelles containing chlorophyll.

Chordata organisms with a backbone; vertebrates.

Cinereoargenteus scientific name for grey fox; based on the Greek words

cinereus (ash-colored) and argenteus (silver), in reference to the color of the fox.

Class a taxonomic category ranking below a phylum and above an order.

Classification to sort into groups.

Climate weather condition of an area including prevailing temperature and average daily/yearly rainfall.

Compound substance having two or more different elements united chemically in a fixed ratio.

Coniferous a cone-bearing tree such as a pine or fir tree.

Conservation is a scientific discipline that seeks to understand the effects of human activities on species, communities, and ecosystems and to develop practical approaches to preventing the extinction of species and the destruction of ecosystems.

Constant temperature zone an area in a cave in which the temperature stays at 58 degrees regardless of weather on the surface.

Cytoplasm contents of a cell between the nucleus and the plasma membrane that contains the organelles.

D

Deciduous plants that shed their foliage at the end of the growing season.

Desert an area that receives less than 10 inches of rainfall a year and has a very high rate of evaporation.

Dichotomous key a way of identifying unknown organisms by constructing a series of couplets, each couplet consisting of two separate statements, by reading the statements from broad to narrower characteristics only a single choice will remain.

Drought a long period of low rainfall.

E

Ecosystem all the living organisms in a given area as well as their physical environment—usually made up of many complex interactions.

Eukaryotic an organism whose cells contain a distinct membrane-bound nucleus.

Evolution changes that occur in the members of a species with the passage of time, often resulting in increased adaptation of organisms to the environment.

F

Family the category ranking below an order and above a genus in the taxonomic classification.

Fauna animals, especially of a region or period.

Filament is the part of the flower that holds the anther.

Flora plants, especially of a specific region or period.

Flower the reproductive unit of angiosperm.

Flower stalk the structure that supports the flower.

Fungi any organism that lacks chlorophyll, includes yeast, molds, smut, and mushrooms. One of the 5 major kingdoms.

G

Genus category ranking below a family and above species in the hierarchy of taxonomic classifications.

Global warming predicted increase in the Earth's temperature, due to the greenhouse effect, which will lead to the melting of polar ice and a rise in sea levels.

Golgi body a flattened, layered, sac-like organelle that looks like a stack of pancakes and is located near the nucleus. It produces the membranes that surround the lysosomes. The Golgi body packages proteins and carbohydrates into membrane-bound vesicles for “export” from the cell.

H

Habitat the place where an animal lives.

Hypothetical an answer to a question based on the best educated guess possible.

I

Internode the area of the stem between any two adjacent nodes.

K

Kingdom the highest taxonomic classification into which all organisms are grouped.

L

Lamina the blade of a leaf.

Lateral shoot an offshoot of the stem of a plant (branches).

Leaf an outgrowth of a plant that grows from a node in the stem. Most leaves are flat and contain chloroplasts; their main function is to convert energy from sunlight into chemical energy (food) through photosynthesis.

Leaf apex the outer end of a leaf; the end that is opposite the petiole.

Lysosome spherical organelles surrounded by a membrane; they contain digestive enzymes.

M

Mammalia mammals.

Midrib the central rib of a leaf—it is usually continuous with the petiole.

Microhabitat a small area where an organism lives that has different conditions from another small area that might be right next door.

Mimicry a superficial resemblance of two or more species; a mechanism that avoids predation by appearing to be dangerous.

Mitochondrion a microscopic structure in nearly all living cells, containing genetic material and enzymes important for cell metabolism. Plural

Mitochondria.

N

Natural selection mechanism of evolution caused by environmental selection of organisms most fit to reproduce; results in adaptation to the environment.

Nocturnal most active at night, sleeps most of the day.

Node the part of the stem of a plant from which a leaf, branch, or aerial root grows; each plant has many nodes.

Nuclear membrane a membrane that surrounds the nucleus.

Nucleolus an organelle within the nucleus; it is where ribosomal RNA is produced.

Nucleus a spherical body containing many organelles, including the nucleolus; it also controls many of the functions of the cell and contains DNA.

Nucleus a membrane-bound organelle with a cell that contains chromosomes and controls the structure and function of the cell.

O

Order the category ranking below class and above family in the hierarchy of taxonomic classification.

Ovary is a female reproductive organ in plants that produces ovules.

P

Petal is one of the leafy structures that comprise a flower, they are usually brightly colored and have many different shapes.

Petiole a leaf stalk; it attaches the leaf to the plant.

Photosynthesis the process by which plants use the sun's energy to convert carbon dioxide and water into sugar.

Phylum category below a kingdom and above a class in the hierarchy of taxonomic classifications.

Pigment a substance, such as chlorophyll, that produces a characteristic color in the plant and animal kingdom.

Prokaryotic cell lacking a membrane-bound nucleus and organelles, the cell type within the domain Bacteria and Archaea.

R

Raptor a bird of prey.

Ribosome small organelles composed of RNA-rich cytoplasmic granules that are sites of protein synthesis.

Riparian relating to the banks of a natural course of water.

Root is a plant structure that obtains food and water from the soil, stores energy, and provides support for the plant. Most roots grow underground.

Root cap a structure at the ends of the roots, it covers the growing end of the root.

Rough endoplasmic reticulum (rough ER) a vast system of interconnected, membranous, in-folded, and convoluted sacks that are located in the cell's

cytoplasm. Rough ER is covered with ribosomes that give it a rough appearance. Rough ER transport materials through the cell and produce proteins in sacks called cisternae.

S

Sepal small leaves located directly under a flower—they are the outermost part of a flower.

Simple leaves that are not divided into leaflets.

Smooth endoplasmic reticulum (smooth ER) a vast system of interconnected, membranous, in-folded, and convoluted tubes that are located in the cell's cytoplasm. Smooth ER transports materials through the cell.

Species a group of similarly constructed organisms capable of interbreeding and producing fertile offspring; organisms that share a common gene pool.

Stamen in flowering plants, the portion of the flower that consists of a filament and an anther containing pollen sacs where pollen is produced.

Stem (also called the axis) the main support of the plant.

Stigma the uppermost part of the pistil, the female reproductive tissue of a flower, receives the male pollen grains during fertilization, when they travel through the style to the ovary.

Stipule the small, paired appendages (sometimes leaf-like) that are found at the base of the petiole of leaves of many flowering plants.

Stomata small pores in a tree's leaves and stems that open to absorb carbon dioxide and release oxygen.

Style is part of the pistil, the female reproductive tissue of the flower; a long tube located on top of the ovary and below the stigma.

Survival of the fittest Darwin asserted that in order for a species to cope with the ever-changing environments and circumstances it is subjected to, it must not only adapt, but must also be capable of passing on those adapted characteristics to its offspring.

T

Taproot the main root of some plants; the taproot extends straight down under the plant.

Taxonomy a branch of biology concerned with identifying, describing, and naming organisms.

Terminal bud a bud located at the apex of the stem.

Theoretical answer based on a theory.

Transpiration the process by which a tree loses water through stomata on its leaves and stems.

Troglobites are animals that only live in caves. They can't survive anywhere else.

Troglophiles are animals that like to live in caves but also can live elsewhere.

Trogloxenes are animals that sometimes choose caves as their homes.

Twilight zone the part of a cave in which some daylight penetrates (but not direct sun light) and gradually diminishes to zero light.

U

Urocyon the genus name based on the Greek words oura (tail) and kyon (dog).

V

Vacuole a large, membrane-bound space within a plant cell that is filled with fluid. Most plant cells have a single vacuole that takes up much of the cell.

Variable temperature zone the temperature inside fluctuates with the weather outside the cave.

Vegetative propagation the term given to any asexual means of starting new plants.

Vein one of the many vascular structures on a leaf; they provide support for the leaf and transport both water and food through the leaf.

W

Whorls a group of three or more leaves of the same kind, arising at the same level on a stem and arranged in a circle, the petals of a flower or the branches of a horsetail.

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